# Spin polarization transport in $ZnO/La_{2/3}Sr_{1/3}MnO_3$ heterostructures

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## Abstract

$ZnO/La_{2/3}Sr_{1/3}MnO_3$ thin fims have been epitaxially grown on on $LaAlO_3$ (100) substrates. The photo-responsive resistance and magnetoresistance in fabricated $ZnO/La_{2/3}Sr_{1/3}MnO_3$/ $LaAlO_3$ heterostructure were investigated. The photoinduced resistance and demagnetization versus temperatures demonstrates that the optical field dominated the photoconductivity mechanism below Curie temperature Tc from 155mW/cm$^2$ and 190mW/cm$^2$ green-light source. The shape and size of the barrier were changed by junction interface and interface tensile strain due to optical and magnetic external perturbations which the photoinduced characteristics modified the carrier density at the LSMO/ZnO interface. Additionally, the $La_{1-x}Sr_xMnO_3$/ZnO heterostructure exhibited a positive colossal magnetoresistance (MR) effect over the range of 50–300 K and a positive PR effect over 50–210 K. The maximum MR values were determined to be about 25.948% at H=0.5T, 24.89% at H=0.3T and 22.764% at H=0.1T. We prepare the $ZnO/La_{2/3}Sr_{1/3}MnO_3$ heterostructure fabricated on LAO substrate on atom level and clipping quantum energy bond by multilayers heterostructure. The X-ray diffraction shows that the LSMO has the rhomohedral structure. The $ZnO/La_{2/3}Sr_{1/3}MnO_3$ heterostructure has temperature phase transition, photoinduced resistance and magnetic resistance effect. The junction photoinduced resistance and magnetic resistance of ferromagnetic spin are dominated by charge order, spin-orbital coupling, magnetic order, optical field and lattice structure from the view of energy band clipping in $ZnO/La_{2/3}Sr_{1/3}MnO_3$ heterostructure. Additionally, we report photoinduced resistance in $ZnO/La_{2/3}Sr_{1/3}MnO_3$ heterostructure on intense laser illumination, weak laser, and pulse laser 160 mW/cm$^2$ and 200 mW/cm$^2$, which the junction transition Tp is 175k. In the temperature range T<235k, the junction is ferromagnetic metallic state, and in the temperature range above 235k, the junction is in paramagnetic non conductive state or antiferromagnetic.

## Keywords

Photoresistance effect; Heterojunction films; Electronic spins; Semiconductor ferromagnetic

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